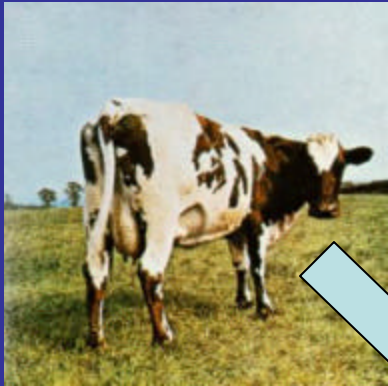# Testing Variables for Monitoring Estuarine Nutrient Enrichment within North Atlantic Parks: Measuring Agents of Change

Luke Cole, Scott Nixon, Steve Granger

Graduate School of Oceanography, URI

*Coordinator: Bryan Milstead, NPS*

Nitrogen Inputs to Marine Systems

Acadia National Park, ME
http://rosswarner.com/131b.jpg

Parks Involved

- **Acadia National Park, ME**
  - ACAD
- **Cape Cod National Seashore, MA**
  - CACO
- **Fire Island National Seashore, NY**
  - FIIS
- **Gateway National Recreation Area, NY/NJ**
  - GATE
- **Assateague Island National Seashore, MD**
  - ASIS
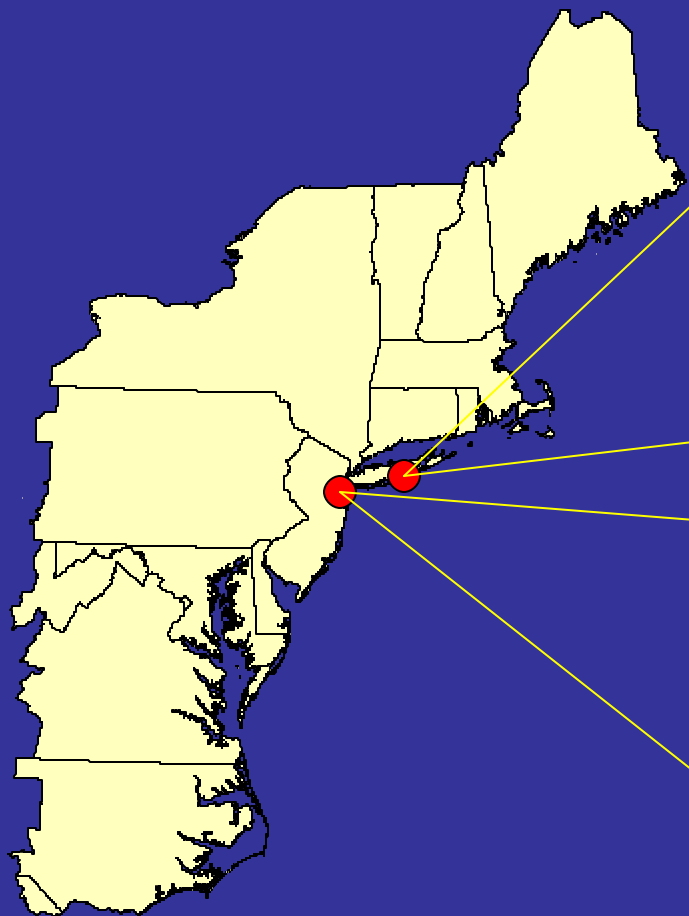- **Colonial National Historical Park, VA**
  - COLO

Parks In NPS Study
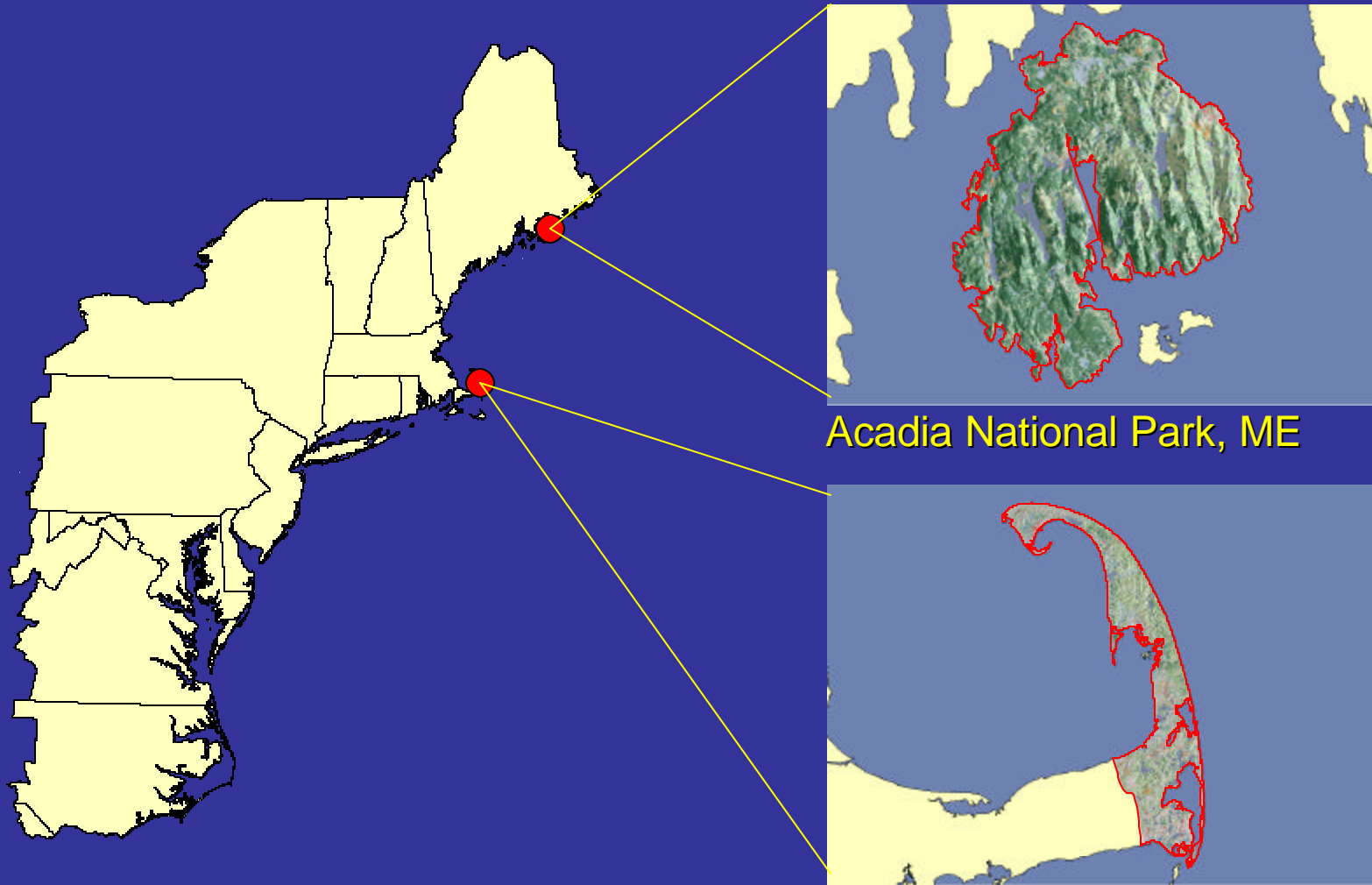
Acadia National Park, ME

Cape Cod National Seashore, MA
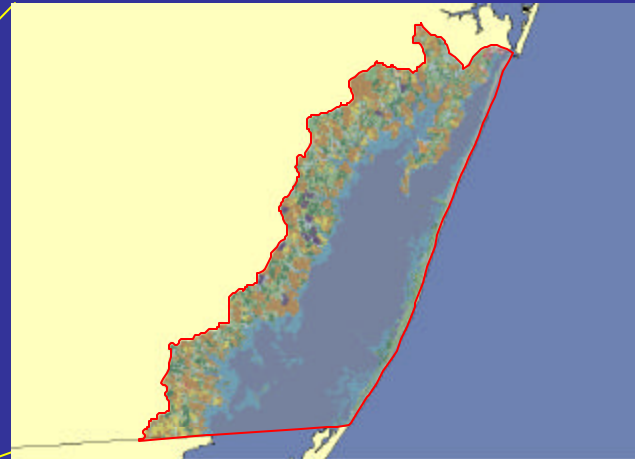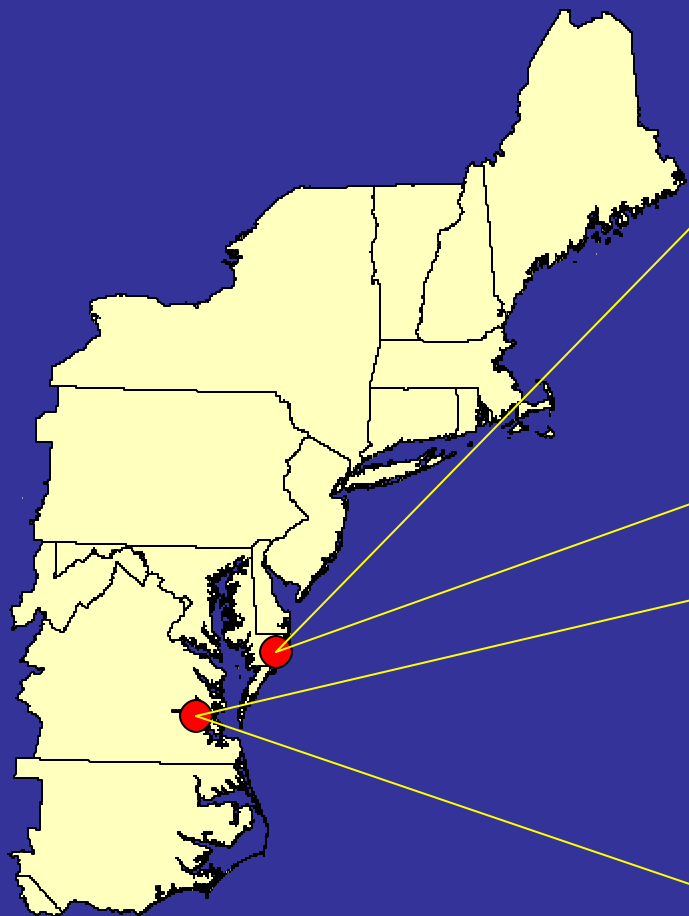
Parks In NPS Study

Fire Is. National Seashore, NY

Gateway Natl. Rec. Area, NY/NJ

Parks In NPS Study

Assateague Is. Natl. Seashore, MD

Colonial Natl. Historical Park, VA

Project Goals

- **Delineate a Sphere of Influence**

- **Establish a GIS Inventory for each Park**
  - Watershed/Elevation
  - Land Use
  - Census
  - Fertilizer/Manure
  - Livestock
  - Soils

- **Assemble Pertinent Non-GIS Data**
  - Fertilizer use
  - Livestock coverage
  - Crop Coverage
  - Water consumption
  - WWTP discharges
  - Direct Atmospheric Deposition

- **Apply Nutrient Models** (NLM, MANAGE)

- **Analyze Historical Data**

Spheres of Influence

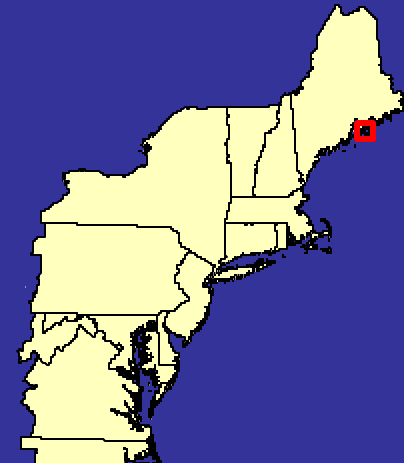**A sphere of influence was delineated around each park based upon:**

- Watershed
- Coastline
- Political Boundaries
- Water Bodies
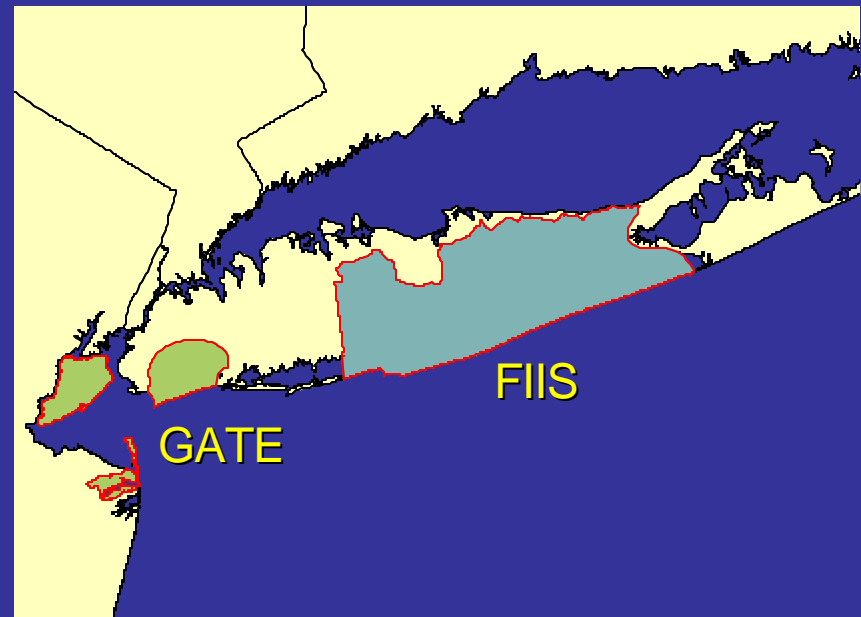
GIS Content

Land Use and Elevation

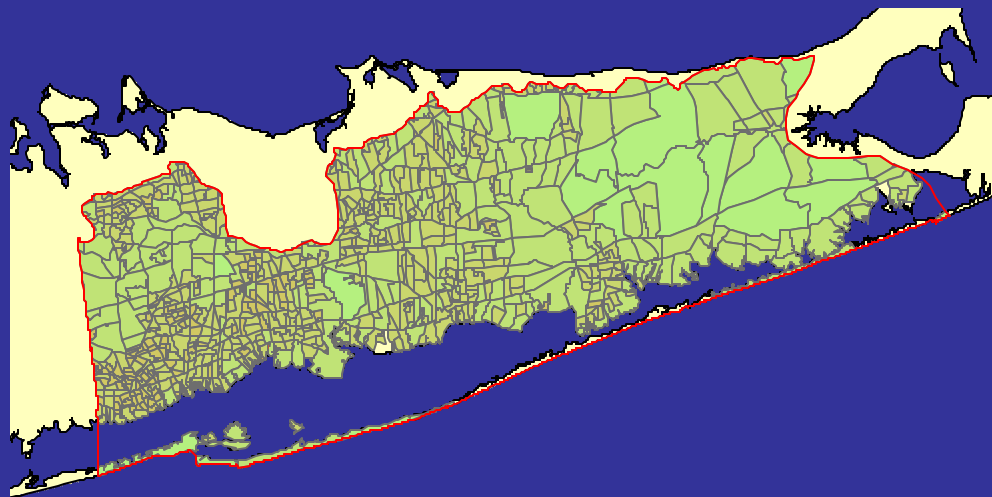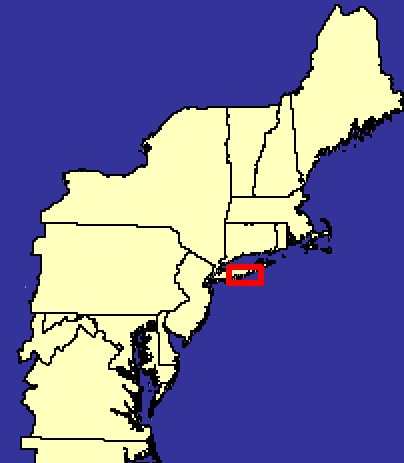Example: *Acadia National Park*

Land Use   +   Elevation Model   =

GIS Content

Census Data

Example: *Fire Island National Seashore*

Note: Data from 2000 US Census and is normalized by area (people ha^{-1})

Modeling

- **Assemble GIS and numerical data**
- **Models to be used:**
  - Valiela N-Loading Model

    Valiela, I., G. Collins, J. Kremer, K. Lajtha, M. Geist, B. Seely, J. Brawley, and C. H. Sham. 1997. Nitrogen loading from coastal watersheds to receiving estuaries: new method and application. Ecological Applications 7(2):358-380.

  - MANAGE N-Source Model

    Kellogg, D.Q., L. Joubert, and A.J. Gold. 1997. MANAGE: A Method for Assessment, Nutrient-loading, And Geographic Evaluation of Nonpoint Pollution. University of Rhode Island Cooperative Extension, Department of Natural Resources Science. Kingston, RI.

The Models

- **Valiela N-Loading Model** (NLM)
  - Original Use: Waquoit Bay, Cape Cod, MA
  - Assumptions: Similar soil type

    Minimal Agriculture
  - Method: Area-weighted values (e.g. land use)
  - Calculation: Excel Spreadsheet
  - Output: Total N-loading (kg N y^{-1})

The Models

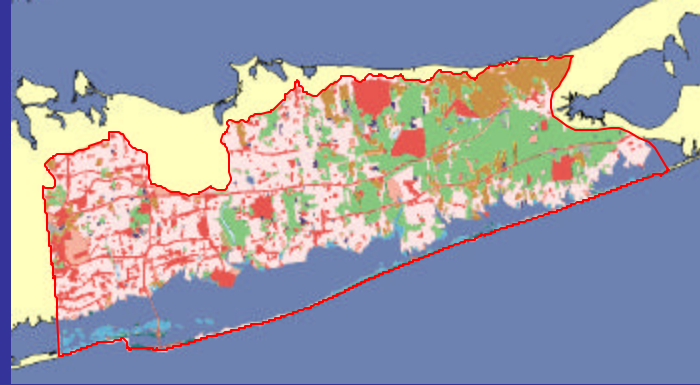- **MANAGE N-Loading**
  - Original Use: Southern NE (MA and RI)
  - Assumptions: No decay or retention
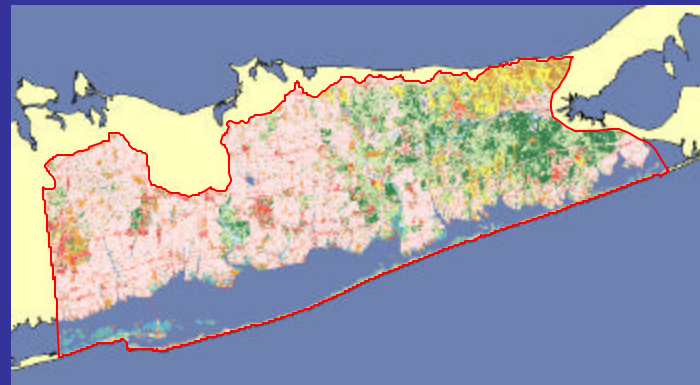 - Method: Area-weighted values (e.g. land use)

    Loading Coefficients
  - Calculation: GIS and Excel Spreadsheet
  - Output: Total N-source (kg N y^{-1})

Historical Analysis

- Data compilation
  - GIRAS Land Use

- GIS Analysis

- Model Analysis

FIIS - Historic Land Use - GIRAS

FIIS - Present Land Use - LULC

Upcoming Steps

- **Run NLM and MANAGE for each park**

- **Compare and QA/QC Results**
  - NLM: N input with retention
  - MANAGE: Gross N source (no retention)

- **Compile Metadata**

- **Prepare Report**